## Remarks

In the present RCE, claim 15-25 are presented for examination.

### Claim Rejections: 35 USC § 102(b)

Claims 15-16, 20, and 22 are rejected under 35 USC § 102(b) as being anticipated by "Exception Handling in Workflow Management Systems" (Hagen). These rejections are traversed.

A proper rejection of a claim under 35 U.S.C. §102 requires that a single prior art reference disclose each element of the claim. See MPEP § 2131, also, *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983). Since Hagen neither teaches nor suggests each element in the claims, these claims are allowable over Hagen.

Independent claim 15 recites numerous recitations that are not taught or suggested in Hagen. By way of example, claim 15 recites three elements (a, b, and c) to predict exceptions <u>before</u> the exception occurs. By contrast, Hagen discloses a model for detecting and handling an exception <u>after</u> the exception has already occurred. Thus, a large difference exists between claim 15 and Hagen. Claim 15 is directed to "predicting" exceptions before they occur, whereas Hagen is directed to "handling" exceptions after they have already occurred.

Applicants respectfully remind the Examiner that anticipation is established only when a single prior art reference discloses each and every element of a claimed invention united in the same way. <u>RCA Corp. v. Applied Digital Data Systems, Inc.</u>, 730 F.2d 1440, 1444 (Fed. Cir. 1984). Hagen does not teach or even suggest predicting exceptions.

For at least these reasons, independent claim 15 and its dependent claims are allowable over Hagen.

As yet another example, claim 15 recites generating an exception **prediction** model based on data prepared from past workflow executions. Nowhere does Hagen teach or even suggest an exception prediction model. By contrast, Hagen teaches models for detecting an existing exception or handling an existing exception. As stated in section 5 (Exception Handling), Hagen discusses detecting exceptions and handling exceptions.

Hagen, though, never mentions or suggests predicting exceptions before they occur using a prediction model.

Applicants respectfully remind the Examiner that anticipation under section 102 can be found only if a single reference shows exactly what is claimed (see, *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985)). Hagen does not teach or even suggest using a model to predict exceptions before the exceptions occur.

For at least these reasons, independent claim 15 and its dependent claims are allowable over Hagen.

As yet another example, claim 15 recites using the exception prediction model to generate a prediction of an exception for a current instance of a workflow. Nowhere does Hagen teach or even suggest using an exception prediction model to generate a prediction of an exception. By contrast, Hagen teaches models for detecting an existing exception or handling an existing exception. As stated in section 5 (Exception Handling), once an exception is detected, process goes to an exception handler. Hagen discusses detecting exceptions and handling exceptions. Hagen, though, never mentions or suggests predicting exceptions using a prediction model.

Applicants respectfully remind the Examiner that for a prior art reference to anticipate under section 102, "[t]he elements must be arranged as required by the claim," see M.P.E.P. § 2131, citing *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). Hagen does not teach or even suggest using a model to generate a prediction for an instance of a workflow.

For at least these reasons, independent claim 15 and its dependent claims are allowable over Hagen.

**Claim Rejections: 35 USC § 102(b)**

Claims 23-25 are rejected under 35 USC § 102(b) as being anticipated by Improving Business Process Quality through Exception Understanding, Prediction, and Prevention" (Casati Paper). These rejections are traversed.

Applicants submit a declaration and evidence under 37 CRF 1.131 swearing behind the effective date of the Casati Paper. The declaration and evidence show

conception of the invention prior to the effective date of the Casati Paper and show due diligence from prior to the reference date to the filing date of the present application. The evidence is a signed invention disclosure (with dates redacted) attached hereto.

**Claim Rejections: 35 USC § 103(a)**

Claim 21 is rejected under 35 USC § 103(a) as being unpatentable over "Exception Handling in Workflow Management Systems" (Hagen). These rejections are traversed.

As noted above, Hagen does not teach or suggest all the recitations of independent claim 15. Dependent claim 21 depends from independent claim 15. Thus, for at least the reasons provided in connection with independent claim 15, dependent claim 21 is allowable over Hagen.

**Claim Rejections: 35 USC § 103(a)**

Claims 17-19 and 22 are rejected under 35 USC § 103(a) as being unpatentable over "Exception Handling in Workflow Management Systems" (Hagen) in view of "Web-Interface Driven Exception Handling in ADOME Workflow Management System" (Chiu). These rejections are traversed.

As noted above, Hagen does not teach or suggest all the recitations of independent claim 15. Dependent claims 17-19 and 22 depend from independent claim 15. Thus, for at least the reasons provided in connection with independent claim 15, dependent claims 17-19 and 22 are allowable over Hagen.

# CONCLUSION

In view of the above, Applicants believe that all pending claims are in condition for allowance. Allowance of these claims is respectfully requested.

Any inquiry regarding this Amendment and Response should be directed to Philip S. Lyren at Telephone No. 832-236-5529. In addition, all correspondence should continue to be directed to the following address:

**Hewlett-Packard Company**
Intellectual Property Administration
P.O. Box 272400
Fort Collins, Colorado 80527-2400

Respectfully submitted,

/Philip S. Lyren #40,709/

Philip S. Lyren
Reg. No. 40,709
Ph: 832-236-5529

## INVENTION DISCLOSURE

PDNO 10008149

DATE RCVD ▮▮▮▮▮▮

**Instructions:** *The information contained in this document is* **COMPANY CONFIDENTIAL** *and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.*

**Descriptive Title of Invention:**
**Predicting exceptions in workflow**

**Name of Project:**
**Business Process Intelligence**

**Product Name or Number:**

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):
**planning to submit a paper in the next few months**

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):
**We are developing a prototype**

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):
**NO**

*If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-898-4919 or 970-898-4919.*

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

**NO**

Was the invention built or tested? If so, the date:

**NO**

Was this invention made under a government contract? If so, the agency and contract number:

**NO**

**Description of Invention:** *Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).*
A.  Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)
B.  Advantages of the invention over what has been done before.
C.  Problems solved by the invention.
D.  Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).

**Signature of Inventor(s):** Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [                    ].

| Employee No. | Name | Signature | Telnet | Mailstop | Entity & Lab Name |
|---|---|---|---|---|---|
| 543384 | Fabio Casati | *Fabio Casati* | 236-8437 | 1U-4 | HPL/STL |
| 268161 | Ming-Chien Shan | *signature* | 857-7158 | 1U-4 | HPL/STL |
| 547622 | Li-Jie Jin | *Lijie Jin* | 236-2861 | 1U-4 | HPL/STL |
| 268847 | Umeshwar Dayal | *Umeshwar Dayal* | 857-8431 | 1U-4 | HPL/STL |

*(If more than four inventors, include additional information on another copy of this form and attach to this document)*

Write in Dark Ink on Front Side Only, Please

**Signature of Inventor(s):** Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [                    ].

| 572904 | Daniela Grigori | *Daniela Grigori* | *** EMPLOYMENT TERMINATED *** | | HPL/STL |
|---|---|---|---|---|---|
| Employee No. | Name | Signature | Telnet | Mailstop | Entity & Lab Name |
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| Employee No. | Name | Signature | Telnet | Mailstop | Entity & Lab Name |
| | | | | | |
| Employee No. | Name | Signature | Telnet | Mailstop | Entity & Lab Name |
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Form 3 1 idf.doc, rev. 06/03/00

## INVENTION DISCLOSURE

COMPANY CONFIDENTIAL    PAGE _____ OF _____

**Signature of Witness(es):** *(Please try to obtain the signature of the person(s) to whom invention was first disclosed.)*

The invention was first explained to, and understood by, me (us) on this date: [ ███████████ ]

| Full Name | Signature | Date of Signature |
|---|---|---|
| MEHMET OGUZ SAYAL | *Oguz S* | ████████ |
| Full Name | Signature | Date of Signature |

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**Inventor & Home Address Information:** *(If more than four inventors, include addl. information on a copy of this form & attach to this document)*

Inventor's Full Name

**Fabio Casati**

Street

**731 Barron Ave**

| City | State | Zip |
|---|---|---|
| **Palo Alto** | **CA** | **94306** |

Do you have a Residential P.O. Address? P.O. BOX        City        State        Zip

Greeted as *(nickname, middle name, etc.)*        Citizenship **Italian**

---

Inventor's Full Name

**Ming-Chien Shan**

Street

**13264 Glasgow Court**

| City | State | Zip |
|---|---|---|
| **Saratoga** | **CA** | **95070** |

Do you have a Residential P.O. Address? P.O. BOX        City        State        Zip

Greeted as *(nickname, middle name, etc.)*        Citizenship **US**

---

Inventor's Full Name

**Li-Jie Jin**

Street

**2747  Del Medio ct.**

| City | State | Zip |
|---|---|---|
| **Mountain View** | **CA** | **94040** |

Do you have a Residential P.O. Address? P.O. BOX        City        State        Zip

Greeted as *(nickname, middle name, etc.)*        Citizenship **China**

---

Inventor's Full Name

**Umeshwar Dayal**

Street

**12561 Radoyka drive.**

| City | State | Zip |
|---|---|---|
| **Saratoga** | **CA** | **95070** |

Do you have a Residential P.O. Address? P.O. BOX        City        State        Zip

Greeted as *(nickname, middle name, etc.)*        Citizenship **India**

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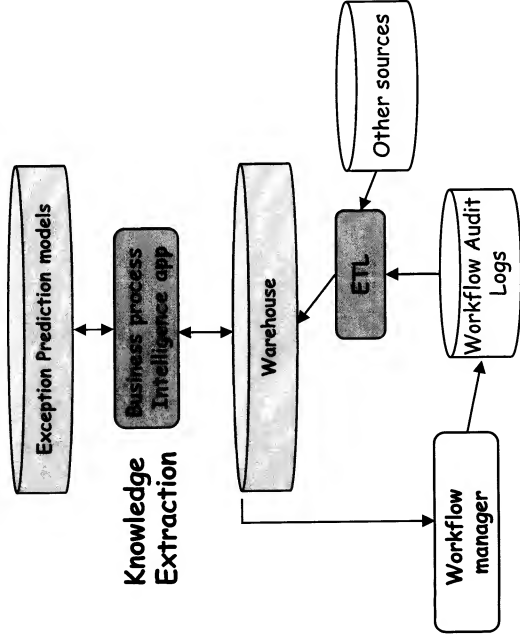
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| **Inventor & Home Address Information:** *(If more than four inventors, include addl. information on a copy of this form & attach to this document)* | | | |
|---|---|---|---|
| Inventor's Full Name **Daniela Grigori** | | | |
| Street **90, rue de Maréchal Oudinot** | | | |
| City **Nancy** | | State **France** | Zip **54000** |
| Do you have a Residential P.O. Address? P.O. BOX | City | State | Zip |
| Greeted as *(nickname, middle name, etc.)* | | Citizenship **Romania** | |

| | |
|---|---|
| **Description of Invention:** | *Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).* |

**A.** Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

The invention allows the prediction of exceptions in a workflow instance. Workflow executions can suffer from many type of exceptions: a deadline for the execution of an activity may expire, the deadline for the entire workflow instance may expire, an activity may return an error, the workflow instance can be canceled (for instance, the customer wants to cancel an order). In addition, the invention also allows the prediction of *when* a given exception will occur. The prediction is done by analyzing data obtained from past workflow executions (see attached figure "preparation"). These data are first extracted to a warehouse. Then, they are analyzed by a *Business Intelligence* application that produces exception prediction models for that workflow. A prediction model is a set of rules that determines the probability that a given exception will occur in a workflow. The model is build by analyzing in which situations each exception has occurred in the past, and by then extracting the knowledge about when it is likely to occur again and under what conditions. Thanks to this knowledge, for each workflow instance, the rules can determine the probability that a given exception will occur in the workflow instance. Predictions are generated by a simple application that applies the prediction rules to the workflow instance execution data, stored in the workflow logs (see attached figure "prediction")

**B.** Advantages of the invention over what has been done before. Other works aims at predicting exceptions. However, they are limited to predicting a specific exception, namely deadline expiration for workflows. In addition, the prediction is only made by computing the average execution time of the workflow activities, and then by estimating the remaining execution time (and hence the termination time). Our invention, based on data mining techniques, allows the prediction of any exceptional event, and even for deadline event we can make a much more accurate prediction. In fact, our prediction models are not simply based on the average execution time, but take into account every aspect of the current and past workflow executions, including value of process data items and resources. Indeed, this additional knowledge enables major improvements in the quality of the prediction.

**C.** Problems solved by the invention. Predicting exceptions allows to prevent their occurrence or to better handle them when they occur. For instance, if we know that a workflow has high probability of not meeting the deadline, we can assign more resources to it or we can raise its priority, so that both the users involved and the system can process its nodes faster. Or we can warn involved people about the possible occurrence of the exception (e.g., warn that a product might not be shipped or might be shipped later than expected). In addition, the prediction models also help the workflow analyst in understanding the causes of the exceptions and consequently in trying to eliminate those causes, so to have better process execution quality.

**D.** Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.). Prior solutions are targeted at predicting deadline expiration for workflow instances. They do this by computing the average execution time for each node, and then by predicting the completion date/time for an instance by looking at the current time and by adding the average execution times of the nodes that remain to be executed. This approach only works if processes are sequential (otherwise there is a problem of knowing which branches and nodes are executed), and it is very inaccurate because it does not take into account the value of workflow data and the resources used in the process, which often greatly affect the execution time of nodes and processes.

# Predicting workflow exceptions - preparation

Components of the invention have a darker background

# Predicting workflow exceptions - prediciton

Components of the invention have a darker background

Prediction (Probability that a given exception will occur, and when it will occur)

Business process Intelligence app

Workflow instance data

workflow Audit Logs

Prediction models